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Response of gibberellic acid on growth and attributes of radish (*Raphanus sativus*)

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ABSTRACT

A field experiment was carried out at the Horticulture Nursery of A.K.S. University, Satna (M.P.) during *winter* season 2021-22. The effect of gibberellic acid (GA) on growth, yield, quality and economics of radish was evaluated. The treatments comprised three varieties and four levels of GA concentration. There were 12 treatments combinations which were replicated three in randomised-block design (factorial). Results recorded maximum growth, yield and quality parameters of radish cultivar Pusa Rashmi with 30 ppm GA concentration. The radish cultivar Pusa Rashmi was observed as highest yielder and capable to give the maximum net profit (Rs.166672/ha) with B:C ratio (3.01) amongst the other varieties, while the concentration of GA at 30 ppm applied as pre-seed treatment enhanced the growth and yield attributes. Thus, it may be considered to be an optimum concentration of GA for producing maximum yield of radish under the existing agro-climatic conditions of the region.

INTRODUCTION

Gibberellic acids (Gibberellins) are naturally occurring plant hormones that are used as plant growth regulators to stimulate both cell division and elongation that affects leaves and stems.Plant growth is a complicated process governed nutritional, genetical and hormonal factors which are correlated and inter-independent. Radish covers an area of 2.84 lakh ha in India with the production of 35.21 lakh tonnes and productivity of 12390 kg/ha. In Madhya Pradesh, the crop occupies 3.14 (‘000) hectare area with the production 195.36(‘000) metric tonnes, and productivity 8.4 metric tonnes/ha during 2021-22. [National Horticultural Board , 2021-22].

Key words: Gibberellic acid, productivity, radish

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There are many influencing factors in radish root production. However, the important ones are proper selection of varieties and use of gibberellic acid and organic manures. Selection of proper varieties and proper use of gibberellic acid plays a crucial role in the production of superior quality of roots but these aspects are very much neglected by the farmers which results in the inferior quality roots and ultimately the poor yields.The appropriate information on the proper dose of gibberellic acid (GA) concentration on radish was lacking in this region, hence the present research work was taken up.

MATERIALS AND METHODS

The field experiment was carried out at the College nursery, Department of Horticulture, A.K.S. University,Satna during the winter season of 2021-22. The soil of the experimental field was clay-loam (medium black) having pH 7.6, electrical conductivity 0.23 ds/m, organic carbon 0.38 %, available N, P_2O_5, K and S 185.6, 12.4, 200 and 7.71 kg/ha, respectively. The treatments comprised three varieties of radish viz. (i) Japanese White, (ii) Pusa Rashmi and (iii) Hill Queen with four GA concentrations (GA 30 ppm, 35 ppm, 40 ppm and control 0 ppm). Thus twelve treatment combinations were replicated at three times in a randomised block design (Factorial). The crop was grown as per recommended package of practices. The plant growth, yield and yield attributing parameters were recorded in each treatment. The data obtained were statistically analysed before presenting the results.

RESULTS AND DISCUSSION

Response of varieties

In the growth characters, plant height and number of leaves were significantly affected by different cultivars may be due to their inherent characters. In case of plant height of plants could produce different measurements. The maximum plant height (69.90 cm) as well number of leaves/plant (17.50) was recorded by the variety Hill Queen (Table 1) and the increases in vegetative growth in Hill Queen variety of radish as compared to

other varieties was noted. These findings are accordance with the results of so many researchers (Singh and Rajodia, 2001 and Mishra and Nagaich, 2019).

The maximum root length (30.06 cm) was recorded by the variety Pusa Rashmi, followed by Hill Queen (29.82 cm) and Japanese White (27.71 cm), which were more or less similar among themselves. The lowest root length was recorded with variety Japanese White. the maximum girth (3.34 cm) of roots was noted by Japanese White, and the lowest diameter (2.29 cm) was recorded with Hill Queen (Table 1). The maximum dry weight (68.54 g) was noted with Pusa Rashmi, while minimum (49.13 g) was recorded in cultivar Hill Queen. The root length and diameter of root were due to the increased activity of photosynthesis and translocation of photosynthates towards the roots. The results were supported by Singh and Rajodia, 2001; Mukherjee and Roy, 2006 and Mishra and Nagaich, 2019.

As regards with the radish yield, the maximum yield (466.74 q/ha) was obtained with radish cultivar Pusa Rashmi which was superior in yield to the improvement of growth and yield parameters (root length and root dry weight). These parameters were closely associated for enhancement of vegetative growth of the cultivars, resulting in the increased yield of radish (Rana and Vashishtha, 1985). In case of quality parameters, Pusa Rashmi gained maximum TSS (5.49 ^{0}Brix) , and lowest TSS (5.20 ^{0}Brix) was obtained with Japanese White. Yield and quality variation among the different cultivars were also reported by many workers under different agro-climatic conditions (Singh and Rajodia, 2001 and Malhotra and Chaudhary, 2001).

Response of gibberellic acid

All the doses of concentrations of gibberellic acid (GA) significantly affected the vegetative growth parameters viz., plant height and number of leaves. The increased vegetative growth might be due to the fact that treated seeds with growth regulators (GA) become more active to enhance cell multiplication and quick cell division. GA 30 ppm was more effective in increasing the morphological characters of plants, as compared to control and

other doses of concentration (GA 35 ppm and GA 40 ppm). Similar results were observed by Singh and Rajodia, 2001 and Mishra and Nagaich, 2019.

The parameters related to yield attributing characters i.e. root length, diameter of root and dry weight of roots were also increased by use of gibberellic acid (GA). The GA 30 ppm was found to be more effective concentration in increasing the length of root (30.25 cm), girth of root (3.16 cm) and dry weight of root (62.60 g) as compared with control (0 ppm GA concentration), which recorded 28.47 cm root length, 2.75 cm diameter of root and 61.79 g dry weight of root (Table 1). The better vegetative growth at foliage might be more effective opportunities for better accumulation of carbohydrates that ultimately affected hill yield. The increase of root size of radish was also Malhotra and Choudhary, 2001.

The maximum yield (454.70 q/ha) was noticed in GA 35 ppm, which was significantly superior to control (403.27 q/ha). While GA 40 ppm and GA 30 ppm reported radish yield of 445.82 and 427.01 q/ha, respectively. The increase in yield of radish was also reported by Singh *et al.,* 1990;Singh and Rajodia, 2001 and Mishra and Nagaich, 2019.

Effect of Interaction (V x GA)

The effect of varieties and different doses of gibberellic acid concentration (GA) was significant in case of plant height, number of leaves, length of root, diameter of root, dry weight and yield, while non-significant in TSS. The treatment combination of GA 35 ppm with Hill Queen showed maximum number of leaves (13, 17 and 19/plant at 30, 60 DAS and at harvest stage, respectively. The maximum length of roots (32.83 cm) was recorded in Hill Queen with GA 30 ppm, whereas maximum diameter (3.63 cm) was obtained in Hill Queen with GA 40 ppm. the maximum yield (537.77 q/ha) was recorded by Pusa Rashmi with GA 40 pm.

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Table 1 Growth and yield-attributes of radish at different growth regulators under different treatments

Treatments	Plant height (cm)at harvest	No. of leaves/ plantat harvest	Length of root (cm)	Diameter of root (cm)	Dry weight of root (g)	Root yield (t/ha)	TSS (^{0}Brix)	Net income (Rs/ha)	B:C ratio
Varieties									
Japanese White	66.20	15.50	27.71	3.34	53.44	374.16	5.20	120383	1.81
Pusa Rashmi	67.25	16.00	30.06	3.15	68.54	466.74	5.49	166672	2.51
Hill Queen	69.90	17.50	29.82	2.29	49.13	457.20	5.31	161894	2.43
S.Em±	**0.505**	**0.165**	**0.345**	**0.025**	**0.400**	**2.578**	**1.278**	**--**	**--**
C.D. (P=0.05)	**1.428**	**0.466**	**0.975**	**0.070**	**1.131**	**7.292**	**NS**	**--**	**--**
GA Concentration									
0 ppm (Control)	68.87	16.33	28.47	2.75	61.79	403.25	5.10	135559	2.08
30 ppm	68.63	15.33	30.25	3.16	62.60	427.01	5.27	146718	2.20
35 ppm	65.60	16.00	29.35	2.78	51.80	454.70	5.23	160442	2.40
40 ppm	68.03	17.67	28.70	3.01	51.95	445.82	5.72	155881	2.33
S.Em±	**0.505**	**0.165**	**0.345**	**0.025**	**0.400**	**2.578**	**1.278**	**--**	**--**
C.D. (P=0.05)	**1.428**	**0.466**	**0.975**	**0.070**	**1.131**	**7.292**	**NS**	**--**	**--**